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SHIGELLA SPECIES (SUB-GROUP A) NOMENCLATURE, A MEMORANDUM

British Bacteriaceae Subcommittee. (Members: Joan Taylor (chairman), H. J. Bensted, J. S. K. Boyd, K. P. Carpenter, W. J. Dowson, R. Lovell, E. W. Taylor, H. G. Thornton, G. S. Wilson, Constance Shaw (Secretary).)

The British Bacteriaceae Subcommittee propose that sub-group A of the Shigella group should be subdivided as follows:

1. Shigella shigae
2. Shigella schmitzii
3. Shigella ambigua

It is felt that Shiga's bacillus by virtue of its biochemical characters, its specific toxin, and its pathogenicity merits a distinctive epithet, rather than being merely a serotype of the non-mannitol fermenting group. Furthermore, greater precision and clearer understanding (Principle 11 of the Code) will be attained if Shiga's name forms the specific epithet, in place of the vague epithet, 'dysenteriae'.

Similarly, it is felt that Schmitz's bacillus is sufficiently distinctive on biochemical and serological grounds and pathogenicity to warrant species recognition.

The International Enterobacteriaceae Subcommittee recommended the epithets flexneri, boydii, and sonnei for species of the mannitol-fermenting subdivision, and the retention of pioneer workers' names (Shiga and Schmitz) is an extension of that recommendation.

S. ambigua is suggested as the name for the Large-Sachs group, that is, for serotypes 3-7 of S. dysenteriae, on the grounds that Bacillus ambiguus (Andrewes) is the earliest name for this mixture of biotypes and serotypes among sub-group A.

NOTES ON THE NAME SHIGELLA AMBIGUA

A MEMORANDUM

British Bacteriaceae Subcommittee

Members: Joan Taylor (chairman), H. J. Bensted, J. S. K. Boyd, K. P. Carpenter, W. J. Dowson, R. Lovell, E. W. Taylor, H. G. Thornton, G. S. Wilson, Constance Shaw (secretary).

Andrewes (1918) in describing "atypical" dysentery bacilli, said (p. 561) of Bacillus ambiguus: "An organism resembling Shiga's bacillus, but forming indol and otherwise separable from Shiga by tests which will be given later. It has no demonstrable relation with human disease". In a fuller description (p. 563) he indicates the frequency with which some reactions occur: for example, he says, referring to indol, that "two strains, otherwise typical, failed to form it".

The description is as follows:

"Produces acid without gas in glucose media, usually in 24 hours, occasionally not till the second day (1 out of 13 strains). Some observers speak of traces of gas being formed; this has not been observed here. The disaccharides are never fermented, with the exception of an occasional late acid formation in saccharose (4-8 days) seen in 3 out of 13 strains. Mannite and dulcite are not fermented. Indol is formed readily in peptone water or broth; two strains, otherwise typical, failed to form it out of 13 examined. In litmus milk there is slight initial acidity, the colour returning later to the starting point or becoming slightly alkaline. Alkali formation in peptone is not very early in onset. Lieutenant-Colonel C. J. Martin states that broth cultures have a stale fishy smell. The organism agglutinates strongly with Michaelis's acid agglutination test; no exception has been found to this. It is inagglutinable with Shiga sera or Y serum; no specific antiserum has been made in this laboratory. No record is to hand of any case in which the organism has been agglutinated by the blood of the patient from whom

it had been isolated. It is sometimes noted as abundant in the stools of "blood and mucus" cases, more often in small numbers. Lieutenant-Colonel Martin notes its presence in stools which also contained Flexner-Y bacilli in abundance. The bacillus appears non-pathogenic to the rabbit unless injected in overwhelming dose."

In 1919 Andrewes and Inman wrote: "Our experience with sera prepared from Schmitz's bacillus (or from the possibly identical B. ambiguus) is small. Such as it is, it suggests marked heterogeneity among the different strains of this bacillus, and little relation with Shiga or Flexner" (p. 12). This sentence reveals clearly that Andrewes was dealing with several serological types of the non-mannitol fermenters and consequently his sera, believed to have been anti-Schmitz, were, in fact, representative of other non-mannitol fermenting serotypes of species.

As a result, it is impossible to assume that Andrewes' B. ambiguus was identical with Schmitz's bacillus; what is clear is that the name B. ambiguus was applied by Andrewes to several serotypes and biotypes of organisms falling within group A of the Shigella classification. Some of his strains may have been identical with the Schmitz bacillus, others with Dudgeon and Urquhart's para-Shiga bacilli of both the + and - varieties, or with Mackie's "atypical B. dysenteriae" numbers 1 - 4.

Lt. Col. H. J. Bensted, writing on 14th July, 1952, of his experience in 1920 at the British Army Central Path. Lab., Constantinople, with sera prepared by Dudgeon in Salonika in 1918, says that not all the indol-negative strains of the so-called para-Shiga groups could be identified with Dudgeon's sera, indicating that these groups were heterogeneous.

The validity of the combination Shigella ambigua has been reviewed (Preliminary Statement, 1951) and it appears to be available for use "if it is ever desired to recognise this serotype as a separate species or subspecies". (p. 160)

It is suggested that Andrewes' B. ambiguus is an earlier name for the Large-Sachs group of dysentery bacilli, and

that it was based on a mixture of biotypes and serotypes. It antedates Dudgeon's name para-Shiga bacillus and it should be applied, if a specific epithet is required for serotypes 3-7 of group A, but it should not be applied to serotype 2 (Schmitz's bacillus).

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BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

CLASSIFICATION OF THE BACTERIACEAE

A MEMORANDUM

British Bacteriaceae Subcommittee

Members: Joan Taylor (chairman), H. J. Bensted, J.S.K. Boyd, K. P. Carpenter, W. J. Dowson, R. Lovell, E. W. Taylor, H. G. Thornton, G. S. Wilson, Constance Shaw (secretary).

The logical extension of the Kauffmann-White schema has led to the recognition of minor antigenic differences between strains, and to the creation of many new species that are no more than the levissimas varietates against which Linnaeus warned us two centuries ago. There is no certainty that these species or serotypes are stable in their hosts, though they may appear to be stable in laboratory cultures. In vitro it is often simple to transform the flagellar antigen or group of antigens of one species into that of another species. It is difficult to believe that this change results from the complete suppression of the first antigen and the development of an entirely new one. It is more probable that each species has a series of antigens or antigenic groups, some better developed than others, and that a change of environment, such as growth in the presence of specific antibody, brings about a change in the relative development of these antigens. Thus a new species may be created from an old, or a known species from a new and unknown type.

It is our opinion that the continual recognition of new species or serotypes, though logical, is unjustifiable, and is leading to confusion. Kauffmann and Edwards (1952) have come to a similar conclusion and have suggested recognising only three species of Salmonella. We think that this is going to the other extreme and we therefore suggest a compromise solution.

Certain species of Salmonella are responsible for well recognised clinical diseases: S. typhi, S. paratyphi-A, B and C for enteric fever in man; S. typhimurium for mouse typhoid; S. pullorum for bacillary white diarrhoea in chicks,

S. abortus-equi for abortion in mares, S. abortus-ovis for abortion in sheep, are examples. Other species are widely distributed and frequently give rise to epidemics of food-poisoning; an example from Great Britain is S. thompson.

We believe that the co-operation of bacteriologists throughout the world should be sought to draw up a list of those species or types of Salmonella that are frequently responsible for clinical infections in man, lower animals, and birds, and that these types should be recognised as species. The less common types should be regarded as serotypes of an unnamed Salmonella species, thus S. london would be referred to as Salmonella sp., III. X.: 1, v1, 6. It is possible, and indeed probable, that some of these serotypes will in time assume greater importance and they could then, by international agreement, be elevated to specific rank.

Detailed antigenic analysis of other groups or genera in the family Bacteriaceae has shown that these, like Salmonella, can be divided into a large number of serological types. In the Shigella group the number of serotypes is, at present, still within reasonable bounds, but in others, such as Bacterium (Escherichia), Klebsiella, Proteus, and the paracolons (Arizona, Ballerup-Bethesda, Providence) the number of serotypes is growing rapidly, and reaching unmanageable proportions. The position may even become worse as serological analysis has been extended to plant pathogens.

Serological typing in the family Bacteriaceae is primarily of clinical and epidemiological importance. There is no reason to believe that the bacteriologist who is interested in the nutritional requirements or metabolic activity of members of the group is likely to pay attention to minute variations in antigenic structure. The bearing of serological typing on curative and preventive medicine should, therefore, be constantly borne in mind. There is at present a lack of all sense of relativity; and a state of bacterial communism is being created in which a rare serotype of Bacterium coli is given a status equal to that of Salmonella typhi or Shigella flexneri, which is absurd.

We believe that the progressive concentration on antigenic

structure is having a pernicious effect on bacteriology. It is being used as an end in itself rather than as a tool, and is diverting attention from much more important problems. We appeal for the exercise of a sense of proportion. In our opinion the biochemical separation of the Bacteriaceae into groups is adequate for most purposes.

We have already suggested that the number of species of Salmonella should be limited, and we now suggest that the same principle should be applied to other groups. Serotypes that have obvious importance, such as Shiga's dysentery bacillus, are worthy of specific rank; others, such as members of the Large-Sachs group are relatively unimportant. Among the paracolons we think that the recognition of biotypes is desirable but that further subdivision into serotypes needs further investigation before the epidemiological significance can be assessed.

The approach we have made to this problem is practical. If we must be logical and extend the classification by antigenic analysis to the whole family, we feel that identical antigens, in whatever group they occur, should bear only one designation.

Our suggestions are put forward so that they may be studied by those interested, and it is hoped that they will lead to a fruitful discussion of the problems of classification and nomenclature of the whole family Bacteriaceae, which includes not only animal and plant pathogens but large numbers of apparently saprophytic organisms.

Provisional Classification of Bacteriaceae

Genus	Species
Klebsiella	(aerogenes (pneumoniae)
	(rhinoscleromatis
Bacterium	(coli
	(intermedium
	(caratovorum
	(tumefaciens
	((salicis)
	((amylovorum)
	(arizonae
	(ballerupensis
	((providenciae)
	(alkalescens-dispar
Salmonella...	(paratyphi-A
	(paratyphi-B
	(paratyphi-C
	(typhimurium
	(abortusequi
	(choleraesuis
	(newport
	(typhi
	(enteritidis
	(gallinarum-pullorum
	(.....
	(.....
Shigella	(shigae
	(schmitzii
	(ambigua
	(flexneri
	(boydii
	(sonnei
Proteus	(mirabilis
	(vulgaris
	(morganii
	(rettgeri

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

INDOL PRODUCTION OF BACTERIA

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W. Frieber (1) has published a list of conditions for indol production by bacteria. It seems desirable to point out that some of his postulates are untenable, as they are in conflict with the experience of many authors. Frieber states that anaerobes do not produce indol. It has been shown, however, by many authors that some anaerobic species are capable of producing indol. Thus a large number of strains of Fusobacterium (2,3,4,5), and of Sphaerophorus necrophorus (6) as well as strains of Bacteroides funduliformis (7), which may be identical with S. necrophorus, have been shown to produce indol. I have found strong indol reactions in cultures of Bacteroides melaninogenicus. It would not be reasonable to suggest that the work of the authors referred to - and of others who have obtained the same results - has not been carried out carefully enough to exclude the possibility of mistakes.

It may be mentioned that it has been claimed (5) that strains of Fusobacterium fail to reduce nitrates, and that their power of acidification of glucose is extremely slight--if any.

Frieber further states that capsule production and production of slime or slime-walls are unfavorable for indol production. Whereas it is true that many encapsulated or mucoid organisms are indol-negative, a considerable number of such strains do produce indol. Thus some encapsulated strains of Aerobacter aerogenes (or Klebsiella according to Kauffmann's terminology) produce indol, and there is no evidence of interference with indol production in mucoid or slime-wall colonies of Escherichia coli. Likewise there is, so far, no report that the encapsulated strains of Haemophilus influenzae differ from non-encapsulated strains in production of indol.

It seems probable that other exceptions to the postulates of

Frieber might be found.

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BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

REPORT OF COMMITTEE ON MEDICAL AND VETERINARY MYCOPATHOLOGY

Walter J. Nickerson, Chairman

The Special Committee on Medical and Veterinary Mycopathology met four times during the course of the Fifth International Congress of Microbiology. The following members were present:

G. C. Ainsworth, E. A. de Area Leao, F. de Almeida, A. L. Carrion, Amadeau Cury (Secretary), C. W. Emmons, J. E. Mackinnon, W. J. Nickerson (Chairman), P. Negroni, P. Redaelli.

The first meeting was convened by the Secretary, Dr. Nickerson, who was subsequently elected Chairman, that office having been previously unfilled. Dr. Amadeau Cury was appointed to be a member of the Committee and was subsequently elected secretary. The death of Dr. M. Langeron, former member of the Committee, was observed by a moment of silence in his memory.

The first meeting of the Committee was devoted to a discussion of its aims and functions, and to a review of work accomplished since its formation in 1948. By unanimous vote, the following resolution was adopted and submitted to the Nomenclature Committee of the Congress.

"The Special Committee on Medical and Veterinary Mycopathology, which was appointed in 1948 (after the Copenhagen Congress), believes that it can serve a very useful and much needed function by considering at an international level various aspects of medical and veteriary mycology.

In addition to questions involving the application of the International Rules of Nomenclature to pathogenic fungi, the Committee would like to consider names of pathogenic fungi which could be recommended for use throughout the world, the standardization of the names of mycotic diseases, the standardization of culture media, and the

maintenance of culture collections of medical and veterinary importance.

The Committee, therefore, unanimously recommends:

1. That the constitution of the Special Committee on Medical and Veterinary Mycology should be confirmed.

2. That in view of the Committee's interest in the nomenclature of fungi the International Botanical Congress should be invited to consider the formal representation of the Committee on Medical and Veterinary Mycopathology with the Special Committee for Fungi of that Congress. (Dr. C. W. Emmons, a member of the Committee, is already a member of the I. B. C. Special Committee for Fungi. Dr. Emmons might be acceptable to the Botanical Congress as a representative of the Committee.)"

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"Le comité spécial de Mycopathologie Médicale et Vétérinaire qui fut organisé en mille neuf cent quarante-huit (aprés le Congrés de Copenhague) croit qu'il peut fort bien jouer un rôle utile et nécessaire en considerant sur le plan international divers aspects de la mycologie médicale humaine et vétérinaire.

En plus des problêmes concernant l'application des réglements internationaux de nomenclatures aux champignons pathogènes, le comité voudrait considérer quels noms, d'usage universels, pourraient être recommandés pour ces champignons. Le comité aimerait de plus étudier la standardisation des noms de mycoses, la standardisation des milieux de cultures et la possibilité de maintenir des collections de culture d'intérêt médical et vétérinaire.

Le comité fait donc aux organisateurs de l'Association Internationale de Microbiologie les recommandations suivants:

a. Que la constitution du comité soit confirmée.

b. Que le Congrés International de Botanique soit invité à considérer la collaboration officielle du Comité de Mycopathologie médicale et vétérinaire avec le Comité Special des Fongis de ce Congrés, puisque ces deux comités sont vitalement intéressés dans la nomenclature des champignons."

In the interim between its organization and its first meeting the Committee had agreed by correspondence that a most urgent matter for its consideration would be the nomenclature of fungi pathogenic for man and animals. Therefore, as a basis for discussion, members of the Committee prepared proposals, on the nomenclature of various organisms or groups, presenting in detail the pertinent information on the organisms in question. The proposals were mimeographed and sent to all members, who were invited to comment on any or all of the proposals. The comments were collected, sent to the author of the proposal who, in turn, prepared a revised statement that might serve as a basis for deliberation at the V Congress. The following proposals were circulated to the members before the V Congress:

Notes on the Taxonomy and Nomenclature of the Dermatophytes by G. C. Ainsworth.

Generic Name for Imperfect Yeasts - Cryptococcus or Torulopsis ? by C. E. Skinner.

On the nomenclature of the Etiologic Agents of Chromomycosis by J. E. Mackinnon.

Actinomyces israeli by M. Langeron.

Copies of the three lists of recommended names of animal disease fungi prepared by regional groups were also sent to Members. The lists were:

1. A compilation of names of pathogenic fungi and synonyms prepared by Dr. S. P. Wiltshire of the Imperial Mycological Institute.

2. Appendix A, Recommendations of the Committee on Medical Mycology of the Mycological Society of America.

3. Nomenclature of Fungi Pathogenic to Man and Animals, Names recommended for use in Great Britain. Medical Research Council Memorandum No. 23.

On the basis of the above proposals and lists of recommended names, a comparative tabulation was prepared and sent to all members before the V Congress. The 2nd, 3rd and 4th meetings of the Committee were largely devoted to consideration of these nomenclatural questions. On the comparative tabulation mentioned previously, names for 50 organisms were listed; of these, ready agreement was reached on recommending for international use 34 names; 2 other names were agreed upon, subject to author citations being checked. Decision was deferred on 5 names pending the outcome of taxonomic studies known to be in progress. There was a lack of agreement on the nomenclature of 7 organisms arising from questions of taxonomy. Dr. G. C. Ainsworth agreed to summarize the Committee's deliberations on these matters and the summary appended is from his report.

The importance of a central collection devoted to cultures of animal disease fungi was emphasized in the Committee's discussions. The extensive collection in the laboratory of Dr. Area Leao was considered to be well suited for development under his direction into such a central collection to which reference cultures should be sent.

Some consideration was given to, but no action was taken on, the problems of standardization of culture media for identification of animal disease fungi, and the nomenclature of mycotic infections. Studies on these problems will be undertaken by members of the Committee for consideration at the next Congress.

LIST OF RECOMMENDED NAMES OF FUNGI PATHOGENIC FOR MAN AND ANIMALS

During the spring of 1950, a comparative tabulation of the tentative lists of names of fungi of medical importance, drawn up by the Mycological Society of America and the Commonwealth Mycological Institute, Kew, and the published Memorandum of the Medical Research Council, was circulated to the Committee for comment. At the V International Microbiological Congress, Rio de Janeiro, in August 1950, the consideration of a choice of names from this tabulation, which the Committee could recommend for international use, was the main business at four long committee meetings.

The following names were unanimously accepted:
(The numbers preceding names are those of the 1950 tabulation.)

4. *Aspergillus flavus* Link
5. *Aspergillus fumigatus* Fresenius
6. *Aspergillus niger* van Tieghem
9. *Candida albicans* (Robin) Berkhout
10. *Candida parakrusei* (Castellani et Chalmers) Langeron et Guerra
11. *Candida tropicalis* (Castellani) Berkhout
12. *Coccidioides immitis* Rixford et Gilchrist
13. *Cryptococcus neoformans* (Sanfelice) Vuillemin
14. *Epidermophyton floccosum* (Harz) Langeron et Milochevitch
15. *Histoplasma capsulatum* Darling
16. *Histoplasma farciminosum* (Rivolta) Ciferri et Redaelli
17. *Malassezia furfur* (Robin) Baillon
18. *Microsporum audouini* Gruby
19. *Microsporum canis* Bodin
20. *Microsporum gypseum* (Bodin) Guiart et Grigoraki
21. *Allescheria boydii* Shear; Stat. Conid:= *Monosporium apiospermum* Saccardo
23. *Nocardia asteroides* (Eppinger) Blanchard
24. *Nocardia caprae* (Silberschmidt) Emmons

25. Nocardia madurae (Vincent) Blanchard
27. Nocardia tenuis Castellani
30. Phialophora verrucosa Medlar
31. Pityrosporum ovale (Bizzozero) Castellani et Chalmers
32. Rhinosporidium seeberi (Wernicke) Seeber
33. Sporotrichum schencki (Hektoen et Perkins) Matruchot
34. Trichophyton concentricum Blanchard
36. Trichophyton epilans Boucher et Mengin
Syn. Trichophyton flavum Bodin (38)
37. Trichophyton ferrugineum (Ota) Talice
40. Trichophyton mentagrophytes (Robin) Blanchard
41. Trichophyton megnini Blanchard
44. Trichophyton rubrum (Castellani) Ota
45. Trichophyton sabouraudi Blanchard
46. Trichophyton schoenleini (Lebert) Langeron et Milochevitch
48. Trichophyton tonsurans Malmsten
49. Trichophyton violaceum Sabouraud

Dr. Negroni agreed to annotate 23, N. asteroides. It was also agreed that 27 and 32 should be annotated to the effect that the fungi have not been cultured.

The following two names were accepted, subject to the author citations being checked:

26. Nocardia minutissima
50. Trichosporon beigelii

Deleted from the list:

22. Monosporium sclerotiale Pepere

No final decision was reached on:

1. Absidia corymbifera (Cohn) Saccardo et Trotter

It was agreed that this name, as a name, was unobjectionable. The taxonomic position of this fungus was considered by

some members to be uncertain and, at the suggestion of Dr. Emmons, it was agreed to defer a decision until after the publication of a monograph on Mucor by Prof. Victor Cutter of Yale University.

2. Actinomyces bovis Harz and 3. Actinomyces israeli (Kruse) Lachner-Sandoval

There was general agreement that the forms attacking man and cattle would probably prove to be distinct and a decision was deferred pending the results of work on this problem known to be in progress.

7. Blastomyces brasiliensis and 8. Blastomyces dermatitidis

Lack of time prevented discussion of these names about which Dr. Area Leao will make proposals to the Committee.

28. Phialophora compacta (Carrion) Redaelli et Ciferri and
29. Phialophora pedrosoi (Brumpt) Redaelli et Ciferri

These two names gave the Committee much trouble in spite of the lucid and informative papers by Dr. Carrion and Prof. Mackinnon setting out the evidence for and against the various issues involved.

The nomenclatural facts appear to be undisputed and, given the taxonomy to be adopted, names in strict accordance with the International Rules of Nomenclature are available.

In Dr. Carrion's view, the species P. pedrosoi could be most naturally accommodated in the genus Fonsecaea. Other members felt that this distinction would be difficult to maintain. It was finally decided to adopt Phialophora in the wide sense for the time being and Dr. Carrion agreed to annotate these names.

Similarly, lack of agreement on classification led to deci-

sions being deferred on:

35. (The faviform Trichophytons)
39. Trichophyton interdigitale Priestly
42. Trichophyton persicolor Sabouraud
43. Trichophyton quinckeanum (Zopf) MacLeod et Muende
47. Trichophyton sulphureum Colcott Fox

INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE

A Review

The Seventh International Botanical Congress (1) in 1950 at Stockholm approved a revised International Botanical Code of Nomenclature, and appointed an editing committee which was authorized to publish. Dr. Lanjouw and the members of this competent committee have completed their task, involving two years of work. The publication was issued under the date of September, 1952. This volume is of major significance to those interested in microbiological nomenclature, particularly to bacteriologists. The International Bacteriological Code of Nomenclature had its origins in the botanical code, and was developed as a distinct code largely because of the inapplicability of certain of the botanical rules to the nomenclature of the bacteria. One of the functions of the permanent Nomenclature Committee as established by the International Association of Microbiologists is "To cooperate with other Committees, particularly those of the International Botanical and Zoological Congresses to consider common problems of nomenclature". All the members of this Committee and of the Judicial Commission should be familiar with the provisions of the revised botanical code in view of the many nomenclatural problems in bacteriology that will be under consideration at the meetings to be held at the time of the Sixth International Congress of Microbiologists in Rome in September of 1953. This review will point out some of the more significant changes that have been made in the botanical code, with emphasis upon those that may be of importance in contemplated revisions of the bacteriological code .

The volume is appropriately dedicated "Librum hunc dedico manibus clarissimi John Briquet". It was Briquet who so successfully influenced and wisely guided the development of earlier revisions of the botanical code. Dr. Lanjouw in a most interesting "Introduction" notes the change of the name from "International Rules" to "International Code". One may echo his sentiment, "Finally I wish to express the

hope that we will not change our Code at every subsequent Congress. There are more important things to do! May the present Code obtain the approval of a very large number of botanists. The Editorial Committee is convinced of the shortcomings of this Code, but it hopes that it will be given a fair trial".

The revised Botanical Code includes three chapters and six appendices. There is a satisfactory Subject Index and a most useful "Key to the numbering of the Articles and Recommendations" which enables one to relate the newly numbered articles and recommendations of the Code Stockholm to those of the rules of edition 3 and to those of the Synopsis Stockholm.

The three chapter headings of the older Codes are unchanged in the new revision. The first of these "General Considerations and Guiding Principles", includes two additional Articles. In Article 8 there is the final formulation of the statement that taxonomic groups throughout the code will be referred to as taxa (singular: taxon). Article 15 of the previous code becomes Article 9. Article 10 is new; it defines five terms which have often been misconstrued, namely legitimate name or epithet, illegitimate name or epithet, the correct name of a taxon, effective publication, and valid publication. It also specifies that, wherever the word name is used, it means a name which has been validly published, whether legitimate or illegitimate.

Chapter II treats of the "Categories of Taxa, and the terms denoting them". Three Articles replace five, with simpler and clearer phraseology. The older system of numbering recommendations consecutively throughout the Code is replaced by a system similar to that used in the Bacteriological Code; Recommendation I becomes Recommendation 14A.

Most of the revision of the Code is to be found in Chapter III on "Names of Taxa". This Chapter has increased the number of Sections from fifteen to sixteen by dividing former Section 10. In general the headings of the several sections remain with only minor change, the most important perhaps being the increased emphasis upon epithets as well as

upon taxa. The new Chapter III contains Articles 16-83 as contrasted with Articles 15-71 in the former revision. Included are many changes which are of interest to biologists other than botanists. The following modifications are worthy of note.

Article 16 limits the rule of priority to names of orders and of taxa of lower rank. Provision is also made for alternative names for nine specified families. The correct name for any taxon from order to genus inclusive is the earliest legitimate name validly published with the same rank. There is added a new statement relative to the correct name of a taxon below the rank of genus. A correct name for such a taxon is a combination of the generic name with the "earliest available legitimate epithet or epithets validly published with the same rank". Consideration may well be given to similar amendment of Principle 9 of the Bacteriological Code.

Section 2, "The Type Method" has been considerably modified and amplified and increased from one to four Articles. The recognition of the type method is now as complete and adequate in botany as in zoology, and much more complete than in bacteriology. Holotypes, lectotypes and neotypes are defined. Article 20 clearly states that the "type of any order or of any taxon of a rank between order and family is the family whose name is based on the same generic name". Again, the type of a family "or of any taxon between family and genus is the genus on whose present or former name that of the taxon concerned is based". The corresponding rule in zoology states that the name of families and of subfamilies are formed from the stems of the names of the type genera. There is no provision for the use of synonyms of generic names in formation of family names. The draft Rule 3 of the Bacteriological Code would require that the names of families and of intermediate taxa between families and genera be formed from the name of a contained genus and with a recommendation that the name of the type genus be chosen.

The definition of nomenclatural types of specific and subspecific taxa as given in the Botanical Code is quite unrealistic

from the standpoint of the needs of bacteriology. Certainly the type of most bacterial species cannot be defined adequately as a "single specimen or other element" even with the provision that "for non-vascular plants the type may consist of more than one individual".

Article 23 gives the beginning dates of valid publication for each of several groups of plants, but the date for the bacteria is not included. The first International Congress of Microbiologists held in Paris in 1930 formally recommended to the Cambridge International Botanical Congress held likewise in 1930 that the date for beginning of valid publication for the bacteria be fixed as 1753 with Linnaeus Species Plantarum ed. 1. This recommendation was duly presented to the appropriate Section on Taxonomy. It was the understanding of the writer that this date was approved by this Section, but this seems not to have been done, for there is no reference to such action in the subsequent several editions of the Botanical Code. The date is fixed as noted above by Rule 10 of the Bacteriological Code.

Provisions for conservation of names are revised by strict limitation of such conservation to names of "genera, families, orders and intermediate taxa", thereby continuing to exclude from conservation the names of species and their subordinate groups, but permitting the conservation of taxa higher than genera. It should be noted in Chapter 4 Provision 2 of the Bacteriological Code the conservation of generic bacterial names only is provided for, but in the new Provision 5 approved by the Fifth International Congress of Microbiologists (1950) the Judicial Commission was authorized to conserve names of taxa of all ranks.

There appear in Articles 24 and 25 references to several Committees having specific functions. In Article 24 (Note 1) it is stated that proposals of names for conservation will be made to the "General Committee, who will refer them for examination to the Special Committees for the various taxonomic groups". But in the next Article (25) a somewhat different procedure is postulated in the statement providing for provisional approval by "the Advisory Board and General Committee". This Board and these Committees are not

mentioned elsewhere in the code except in a footnote on p. 82 which suggests that certain names should be referred to the "General Committee of Botanical Nomenclature". One who uses the code is left quite uninformed as to the personnel, method of appointment and delegated functions of these committees. To one who as a member of the International Association for Plant Taxonomy knows of the International Bureau for Plant Taxonomy and Nomenclature and through the columns of the publication Taxon is aware of the several Boards and Committees, these references are not complete mysteries. However, it is unfortunate that nowhere in the Code nor in its appendices is there any key to organizational relationships.

A footnote to Note 1 of Article 25 relating to lists of conserved names refers to "Appendix V". This appendix is made up of two lists. The first is named "Nomina familiarum conservanda", but one is left in some doubt as to the real status of the list. It is stated to be a "list composed of the four proposals listed below but not officially acted upon by the Congress". There is no indication that any of the names of families here listed have been given any preliminary approval of the Boards or Committees as directed in Articles 24 and 25. It is unfortunate that the exact status of the names listed is not clear, except perhaps to those who participated in the discussions at Stockholm. Further, it would seem that the names themselves should be reviewed with some care to make sure that the family names as given are in fact derived from the generic names listed (presumably the T standing before the several generic names is an abbreviation of typus). Article 28 states that the name of a family is taken from its type genus or from a synonym and ends in - aceae. Does not this mean that - aceae is to be added to the stem of the generic name? For example, the stem or combining form of Balanops is Balanop- and not Balanopsid-, the correct spelling of the family name would appear to be Balanopaceae. Is Epacridaceae correctly formed? Are the differences in spelling between Alismataceae and Lacistemaceae, derived from Alisma and Lacistema, consistent? Should we conserve family names that are spelled incorrectly?

There follows a long list headed "Nomina generica conservanda". Upon examination, the lists are found to be made up of proposals (printed in italics) not officially acted upon and of those (in bold face) officially accepted by the Congress. One proposal only would seem to concern bacteriologists even remotely, it is that which under Bacillariophyta rejects Gaillonella Bary 1823 and conserves Melosira Kützing 1833. The variant Gallionella has not been disposed of; this is of interest because it has been used as a generic name in bacteriology.

An interesting addition to the rules is Article 26 which states that "rules of priority and typification do not apply to names of taxa above the rank of order". Recommendations suggest the use of the suffix -phyta for names of divisions, except that for the fungi divisional names should end in -mycota. Phyta is evidently the plural of the Greek neuter phytum, but of what is -mycota the neuter plural? Is there not here some etymological inconsistency? The recommendation also states "Words of Greek origin are generally preferable". The recommended class ending for Fungi is -mycetes. One may speculate upon the etymology of class names of flowering plants which should have the plural neuter ending -opsida. Perhaps the authors or proponents of these endings might be persuaded to discuss their derivation and use in some issue of Taxon.

The new Article 27 specifies that the names of orders and suborders shall be derived from the names of the type families and the names of taxa between family and genus from the names of type genera or from synonyms of such names. This is nomenclaturally one of the most important innovations. The bacteriologists now require that such names be derived from the names of contained genera, with a recommendation that the names of the type genera be used, the botanist require that the names be chosen from the names of type genera or synonyms, and the zoologists require that they be formed from the names of the type genera. There would seem to be no very good reason to continue the differences between the bacteriological and botanical codes.

Permission is given in Article 28 to use ten listed family

names which do not conform to the rule but which have been long recognized in botany, though the corresponding correctly formed names are also validated.

Article 29 is in the pattern of Article 28, it specifies that names of subfamilies, tribes and subtribes are plural adjectives formed from the names of type genera or synonyms by the addition of appropriate endings.

Articles 30-32 inclusive expand the directives with reference to the formation of the names of genera and subdivisions. In Article 30 there has been some change in phraseology. "The name of a genus is a substantive, or an adjective used as a substantive, in the singular number." Two phrases have been dropped from the old Article 25 to which this corresponds; "written with an initial capital" and "which may be compared with our family names". Probably few will mourn the deletion of the second of the two phrases, but one wonders why there is no longer the requirement to capitalize generic names. It is not probable that this deletion will change the custom. The rules have not specifically required the use of capital letters for any other taxa, and the new statement makes for uniformity in wording in the several articles. However, in view of the emphasis laid upon use of initial capitals in specific and infraspecific epithets in Recommendation 82G it might have been well to have included in an appropriate article a note recognizing and legalizing the universal custom of writing the names of all genera, of all suprageneric taxa, and of subgeneric epithets with initial capital letters. It is of interest to note that in Article 31 the directive for formation of epithets for subsections and lower subdivisions state that there are "preferably plural adjectives agreeing in gender with the generic name and written with a capital letter". The index (p. 220) fails to note this authorization.

Article 31 includes several innovations, some of them (at least to the reviewer) confusing. The first two paragraphs of this article read: "The name of a subdivision of a genus is a combination of a generic name and a subdivisional epithet connected by a term (subgenus, section, series, etc.) denoting the rank of the subdivision. For subgenera and

sections such epithets are usually substantives resembling the names of the genera". The first question relates to the use of the term subdivision. In Article 13 division and subdivision are defined as names to be applied to taxonomic groups between classes and "Regnum vegetabile". Unfortunately for biology the botanists have continued to use these terms instead of the words phylum and subphylum which do not add to confusion. When one examines the index (p. 225) one reference is found to subdivisio, six references to subdivision, six references to subdivisional epithet and four references to subdivisional name. It is confusing to use a common English word such as subdivision in so many senses.

Under Article 13 subgenus, section and subsection are definitely recognized as categories of taxa. The use of the term epithets rather than names for the names of these taxa is debatable. The following footnote is given in explanation of the use of "Subdivisional epithet". "The editorial Committee decided unanimously that, for subdivisions of genera, the second part of the name should be termed the subdivisional epithet in accordance with recent practice". The whole tenor of Article 31 runs counter to practice in bacteriology and in zoology. For example in both of these fields a subgenus is regarded from the standpoint of nomenclature as having the same status as a genus. Furthermore the biological world has become accustomed to the use of epithet in the phrase specific epithet where it is correctly used in the sense of "a descriptive adjective noun or phrase". Why the name of a subgenus should be regarded as a descriptive phrase or word is not at all clear.

There is also lack of consistency between the phraseologies of Articles 31 and 32. The latter article states "the subgenus containing the type species of a generic name must bear that name unaltered". Note that here a subgenus is definitely regarded as a taxon having a name and is not designated as a subgeneric epithet.

Confusion is certainly also increased by validation of the use of the same subgeneric names in different genera. A subgeneric name becomes an appropriate generic name

when a genus is divided. A generic name becomes an appropriate subgeneric name when genera are united.

Article 33 as revised clarifies somewhat the treatment of specific epithets which consist of more than one word. It reads in part: "If an epithet consists of two words, these must either be united or hyphened." This phraseology might imply that epithets containing more than two words should be rejected. This surely is not intended. It is common custom in the naming of species of parasitic fungi to use as the specific epithet the name of the host, placed in the genitive. Strict application of the rule as phrased would make questionable the acceptability of names of host species if these already contain a specific epithet of two words.

There is a useful addition to the rule: "Epithets not so joined when originally published are not to be rejected but when used must be hyphened."

The Subsection 6 "Names of taxa below the rank of species" consisting of Articles 34-37 has been largely rewritten and clarified. The first statement of Article 34 is helpful: "For nomenclatural purposes, a species or any taxon below the rank of species is regarded as the sum of its lower taxa, if any."

The extent to which subdivision of species may be carried is illustrated by the example: Saxifraga aizoon var. aizoon subvar. brevifolia forma multicaulis subforma surculosa Engler and Irmsch. This is reminiscent of the attempts on the part of bacteriologists to classify the serotypes in certain bacterial genera such as Salmonella.

Article 34, also includes a new concept, stated as follows: "The description of a subordinated taxon which does not include the nomenclatural type of the higher taxon automatically creates a second subordinated taxon of the same rank which has as its nomenclatural type the type of the higher taxon". This is a more generalized statement of a portion of Rule 7 in the Bacteriological Code which reads: "If the species is divided into subspecies, the subspecific epithet of the subspecies containing the type of the species shall be

the same as that of the species".

One marked difference between the Botanical and Bacteriological Codes is evidenced by comparison with Rule 7 of the latter which specifies that "neither within the same species nor within the same genus may two subspecies bear the same subspecific epithet". The Botanical Code (Article 36) permits the use of the same epithet for subdivisions of different species even those of the same genus, but (Recommendation 37C) recommends that such names be avoided. The tendency in bacteriology is to magnify the importance of the subspecific epithet, making it almost coordinate nomenclaturally with the specific epithet. This has its manifest advantages, when a species is divided, a subspecific epithet becomes a specific epithet, and when species are united, specific epithets become subspecific.

Section 5 relating to "Conditions and dates of effective publication" have been modified and clarified. For the most part, they parallel the provisions of the Bacteriological Code insofar as they are applicable to microbiology.

Section 6 (Articles 42-54 inclusive, Recommendations 42A and 54A-54L) expands somewhat the "Conditions and dates of valid publication". One statement from Article 42 is worthy of some comment. It reads: "On and after 1 Jan. 1953, new transfers or new combinations will be considered validly published only when the basonym (name-bringing or epithet-bringing synonym) is clearly indicated with its author and the place and date of publication". The term basonym is increasingly used in discussions of old species which have been renamed. Such basonyms have been carefully noted in many monographs on the bacteria. For example, in the sixth edition of Bergey's Manual of Determinative Bacteriology, p.774, one finds that Burkholder (p.165) gives a new combination Xanthomonas lactucae - scariolae (Thornberry and Anderson) comb. nov. He notes as a synonym Phytomonas lactucae - scariolae Thornberry and Anderson, Phytopath., 27:109, 1937. The species when transferred to the genus Xanthomonas has as its basonym Phytomonas lactucae - scariolae, the epithet-bringing synonym.

Certain recommendations are of interest. 54A states: "The name of a new taxon should not be published without indication of its type and, if possible, the place where the type is preserved." The statement is somewhat ambiguous as obviously one cannot indicate the place where the type of a family is preserved. Probably the statement should be interpreted to mean that types of all newly named taxa should be designated, and where possible, the place should be noted where the type of each species and subdivision of a species is preserved. This admonition is becoming of increasing importance in bacteriology.

There is also some element of ambiguity in Recommendation 54C which states: "Authors should avoid adoption of an epithet which has been previously published in an illegitimate combination." This would seem to mean that in giving a new name to a previously described species one should avoid using in the new species name an epithet that had previously been used in an older illegitimate name for the species. One is surprised after this admonition to find that in Article 81 provision is explicitly made to use such an epithet if there is in the new position no obstacle to its use.

Section 7 on "Citation of author's names and of literature for purposes of precision" includes a new Article 57 of considerable interest to those who in bacteriology are discussing the wisdom of the conservation of the genus Bacterium. The Article reads: "Retention of a name in a sense which excludes the type can be effected only by conservation. When a name is conserved so as to exclude its type, it must not be ascribed to the original author with such expressions as emend., mutatis charact., etc.; but the name of the author whose concept is conserved must be cited as authority." Pertinent is also Recommendation 60G: "If a generic name antedated by one of its synonyms or by a homonym is valid on account of being a nomen conservandum, the words nom. conserv. should be added to the citation." The generic Bacterium as recommended for conservation would be Bacterium Lehmann and Neumann, 1896 nom. conserv. non Bacterium Ehrenberg 1828.

The second and third paragraphs of Article 73 which deal

with legitimacy of epithets are not easily understood, and on first reading they may seem to be contradictory. Article 73 states: "The publication of an epithet in an illegitimate combination must not be taken into consideration for purposes of priority except in the rejection of a later homonym." The next paragraph reads "A specific epithet is not illegitimate merely because it was originally published under an illegitimate generic name, but must be taken into consideration for purposes of priority if the epithet and the corresponding combination are in other respects in accordance with the rules." It would seem that the illegitimacy of a binomial may be determined either by the legitimacy of the specific epithet or by the legitimacy of the generic name or both. The rule apparently means that the legitimacy of a specific epithet is not determined by the legitimacy of the accompanying generic name, but only by the history of specific epithets previously applied to this species.

Throughout the code is the implicit recognition of the fact that a specific epithet is not the name of a taxon. Rule 74 states: "A name of a taxon is illegitimate and must be rejected if it is a later homonym, that is if it duplicates a name previously and validly published for the name of a taxon of the same rank based on a different type." It is apparent that the legitimacy of a specific epithet is not determined by this article.

Attention has already been called to the fact that Article 81 definitely approves what is urged as undesirable in Recommendation 54G.

Article 82 relating to orthography of names and epithets has been somewhat modified. It now reads: "The original spelling of a name or epithet must be retained, except typographic or orthographic errors. When two or more generic names are so similar, and the plants so closely related, as to cause confusion they are to be treated as variants of the same name." A footnote states: "When it is doubtful whether names are sufficiently alike to be confused, they should be referred to the General Committee of Botanical Nomenclature." Several of the notes appended in Article 82 are of interest in bacteriology. Note 2 states: "The use of a

wrong connecting vowel or vowels (or the omission of a connecting vowel) in a name or epithet is treated as an orthographic error." Strict observance of this regulation would lead to a great number of changes in bacteriology. This would be particularly true of compound adjectives derived from Latin words in which the connecting vowel has been quite commonly -o- instead of -i-.

Note 4 is also of interest: "When changes made in orthography by earlier authors who adopt personal names in nomenclature are intentional latinizations they must be preserved." We find for example specific epithets in bacteriology derived from the name of Pasteur spelled in some cases by the author as pastorianus and by others as pasteurianus.

An example of retention of an original spelling less desirable philologically is the deliberate choice by Linneaus of Amarantus instead of the better Amaranthus. This parallels the choice of the specific epithet megaterium as used by deBary rather than the philologically better megatherium. The retention of original spelling applies also to differences in ending of Greek words transliterated into Latin, for example, Phoradendron Nutt. must not be altered to Phoradendrum. The citation of ceylanica and zeylanica as examples of orthographic variants is of interest.

The fact that the zoological directive for the formation of the genitive from the name of a man in the making of a specific epithet is to add -i while the general directive in botany and in bacteriology is to add -ii has led to much confusion in biological literature. Recommendation 82C (d) states that: "When the name ends in a consonant, the letters -ii are added, except when the name ends in -er, then -i is added." Permission to correct such specific epithets ending in a single -i is given as follows: "Those who follow this Recommendation may treat the termination -i as an orthographic error and correct it."

Recommendation 82F reads: "New specific epithets should be written in conformity with the spelling of the words from which they are derived and in accordance with the accepted

usage of Latin and latinization." The last part of this statement again calls attention to the failure of the botanists to outline accepted usage in the latinization of Greek words.

Recommendation 82H is a very helpful statement by R. E. Latham with reference to classical usage in the formation of compound names and epithets from Greek or Latin. These should be formed as far as practical in accordance with classical usage. Of particular significance is the following statement (d): "If the stem ends in a consonant, a connecting vowel, Greek -o-, Latin -i-, is inserted before a following consonant. Some irregular forms, however, have been extensively used through false analogy (atro-purpureus, on the analogy of pseudo-compounds such as fusco-venatus in which -o- is the ablative case-ending). Where such irregularities occur in the original spelling of existing compounds, this spelling should normally be retained." This would seem to justify the retention of such epithets and names as albidoflavus, albocerus, Aureogenus, nigromaculans and atrofaciens, so commonly used in bacteriology.

REFERENCE

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THE YEASTS= A TAXONOMIC STUDY
A Review

R. E. Buchanan, Ames, Iowa, U. S. A.

This volume of 713 pages by Dr. J. Lodder, mycologist of Koninklijke Nederlandsche Gist- en Spiritusfabriek of Delft and Dr. N. J. W. Kreger van Rij, mycologist of the Centraalbureau voor Schimmelcultures, Yeast Division, Delft, is a highly welcome and authoritative summary of our knowledge of the yeasts. It may be regarded as a revision and condensation of the several volumes on taxonomy and nomenclature of the yeasts previously prepared by the staffs at Baarn and at Delft.

The introduction notes that specific epithets previously given to yeast species by earlier authors have in general been corrected in this text when not formed in conformity to the articles and recommendations of the revised International Botanical Rules of Nomenclature.

After a survey of literature and experience, the authors, for purposes of genera and species differentiation, fix upon six morphological characters (characteristics of vegetative reproduction, shape and size of cells, ascospore formation, ballistospores, and colony characteristics) and twelve physiological properties (pellicle formation, fermentation, sugar assimilation, utilization of nitrate, utilization of ethanol as a sole source of carbon, splitting of arbutin, production of carotenoid pigments, production of starch-like compounds, production of esters, reaction in litmus milk, splitting of fat, and acid production). These are clearly defined and the methods for laboratory determination outlined.

The taxonomic problems related to yeast variability are reviewed with understanding and discrimination. The artificial nature of the group called yeasts is satisfactorily emphasized, as well as the practical utility of this grouping.

Three families are recognized, the Endomycetaceae including yeasts which form asci and ascospores, the Sporobolomycetaceae which produce so-called ballistospores on sterigmata from which they are forcibly dis-

charged, (resembling the spores of the Basidiomycetes), and the asporogenous yeasts placed in the Cryptococcaceae.

The ascogenous yeasts are included in the fungus class Ascomycetes, the subclass Protascales and the order Endomycetales. A single ascogenous yeast family is recognized, the Endomycetaceae which in turn includes five subfamilies, as follows:

Eremascoideae, with one genus Eremascus
Endomycetoideae, with two genera, Endomyces and Schizosaccharomyces.
Saccharomycetoideae, with three tribes
Endomycopseae, with one genus Endomycopsis
Saccharomyceteae, with five genera, Saccharomyces, Pichia, Hansenula, Schwanniomyces and Debaryomyces.
Nadsonieae, with three genera, Saccharomycodes, Hanseniaspora and Nadsonia.
Nematosporoideae, with three genera, Monosporella, Nematospora, and Coccidiascus.
Lipomycetoideae, with one genus, Lipomyces.

There are several anomalies in the above nomenclature that deserve comment. On the basis of the directives of the Botanical Code, the name of the family Endomycetaceae is derived from the name of the contained genus, Endomyces. The inappropriateness of the family name is evident from the footnote (p. 53) which states:-. "This genus does not belong to the yeasts in the proper sense". The authors do not discuss in detail the priorities of the names Endomycetales and Saccharomycetales for the order, nor of Endomycetaceae and Saccharomycetaceae for the family. This failure on the part of the authors to justify the use of names of taxa higher than the genus is unfortunate. The recognition of Endomycetaceae as the family name is apparently based upon the statement of Stelling-Dekker (1931, p. 522) who says:-

"Unter diesen Umständen empfiehlt es sich, die in dieser Abhandlung beschriebenen Organismen - also neben den

typischen Hefearten auch die Vertreter der Gattung Endomyces - in einer Familie wofür dann der ältere Namen Endomycetaceae angebracht ist, vereinigt zu halten."

A hasty examination of the literature seems to indicate that the Stelling-Dekker statement may be incorrect. The first definite use of Saccharomycetaceae as a family name found by the writer is that of DeToni (1889, p. 916) in Saccardo's Sylloge Fungorum. He ascribes the name to Reess (1870). A study of the paper by Reess fails to confirm such use of the name; the family name was not given by Reess. The first use of the name Endomycetaceae found is that of Schroeter (1897 p. 154) in the Pflanzenfamilien of Engler and Prantl. If all of the yeast genera are to be included in a single family, it would seem that the family name should be Saccharomycetaceae.

It is of interest to note that the authors list three species of Endomyces, describe none of them, and in effect, remove them from consideration as yeasts.

The writer believes that nomenclatural confusion and taxonomic difficulties will be minimized if the older differentiation of the two families, Saccharomycetaceae and Endomycetaceae is maintained. The apparent nomenclatural centering of the whole group of yeasts around an ascus-bearing mold (Endomyces decipiens) parasitic upon the gills of a single species of mushroom makes for confusion.

Beginning with the description of the genus Schizosaccharomyces (p. 81) the format is a model for microbiological systematic monographs. The fifteen genera of the Endomycetaceae are differentiated in a well-organized dichotomous key. For each genus there is included a generic diagnosis, the designation of the type species of the genus, an historical survey of the generic name, a list of the species recognized, and a dichotomous key to the species. This is followed by a systematic discussion of each species, including synonyms, original description and historical survey, standard description (morphological and

physiological characters), origin and characterization of strains studied and designation of the type strain of the species. Drawings of the vegetative and sporulating cells are generally included.

One may question the author's ascription for some of the genera, as for example, (p. 116) the genus Saccharomyces (Meyen) Reess. It would seem that this should be Saccharomyces Meyen, for this author named both the genus and the type species. Possibly the authors intended Saccharomyces Meyen emend. Reess.

Inasmuch as the type species must be one of those included in the first publication of the genus, the type should probably be designated Saccharomyces cerevisiae Meyen emend. Hansen. In several other cases the name of the emending author has been substituted for the name of the original proponent of the name.

The following comments as to other unresolved nomenclatural problems may be made.

1. Clements and Shear (1931 p. 246) apparently designated Saccharomycopsis capsularis Schiönning as the type species of the genus Saccharomycopsis. Lodder and van Rij (1952) designate S. guttulata as the type species and recognize the transfer of S. capsularis to the new genus Endomycopsis Dekker (1931) and designate (1952) this as the type species of the genus Endomycopsis. A careful review should be made to determine whether by virtue of the designation of the same type species for each of the two genera, the genus Endomycopsis is not in fact a later synonym of Saccharomycopsis. It would appear that Saccharomycopsis guttulata is the type species of a nameless genus.

2. On page 96, and on later pages, the recognized species of each genus are listed "in chronological sequence", that is, in the order in which they were described. The format used is one that may give rise to a misinterpretation. The name "Endomycopsis capsularis

(Schiönning) Dekker 1913" would usually be interpreted as meaning that Dekker placed the organism in the genus Endomycopsis in 1913, and not that Schiönning originally described it in that year.

3. The type species of Saccharomyces was designated as S. cerevisiae by Clements and Shear (1931 p. 246).

4. (p. 122) Should not the type species have been listed as Saccharomyces cerevisiae Meyen emend. Hansen?

5. Reess (not Hansen) named Saccharomyces ellipsoideus, as also S. exiguus and S. pastorianus.

6. The genus Debaryomyces was founded by Klöcker upon a single species D. globosus. This would normally, therefore, be regarded as the type species. However, the authors place this first named species in the genus Saccharomyces, and as type species designate Debaryomyces hansenii (Saccharomyces hansenii Zopf 1889). They further recommend that the emended genus be made a nomen genericum conservandum. This recommendation is made to avoid the necessity of erecting a new name to replace Debaryomyces. Careful consideration should be given to the question of the conservation of the name, such action may raise more problems than it will settle. The matter is somewhat further complicated by the fact that Clements inferentially fixed the type species in his designation of Isomyces globosus (Klöcker) Clements as the type of the genus Isomyces proposed as a replacement for Debaryomyces.

7. The authors state that Derx (1948) designated Sporobolomyces roseus Kluyver and van Niel as the type species of the genus. This ignores the earlier (1931) designation of S. salmonicolor Kluyver and van Niel as the type species.

8. The authors accept Bullera alba (Hanna) Derx as

designated by Derx (1948) as the type species of Bullera rather than the Bullera grandispora proposed by Clements and Shear (1931).

9. The "asporogenous" yeasts are placed in the Fungi Imperfecti, with the establishment of a new order, the Cryptococcales containing the single family Cryptococcaceae. Unfortunately there is not given adequate consideration of historical background and reasons. No synonymy is given for the names of these higher taxa. Some careful nomenclatural study seems called for.

10. The frank recognition of the generic status of Cryptococcus is helpful, it may assist in clearing up some of the problems in medical mycology. However, the authors have somewhat oversimplified the problem of such recognition. The type species of Cryptococcus was designated by Clements and Shear (1931) as Cryptococcus fermentum Kuetzing. But the only species described in the original publication by Kuetzing is C. mollis which would be presumed to be the type rather than the later C. fermentum. The designation by the authors of Cryptococcus neoformans (Sanfelice) Vuillemin has much to commend it, without serious question it would bring some much needed stability. But it would seem that for this typification to be accepted some international sanction is needed. Perhaps the simplest, though not the only method of achieving the desired goal, would be for the authors to recommend to the International Committee on the Nomenclature of the Fungi that Cryptococcus Kuetzing be placed in the list of nomina generica rejicienda and that the generic name Cryptococcus Vuillemin be recognized as a nomen genericum conservandum with the type species the Cryptococcus neoformans (Sanfelice) Vuillemin as several times proposed in the literature. Some study also needs to be given to the alternative name C. hominis.

11. The legitimacy of the name Torulopsis Berlese, as used by the authors, is questioned by themselves. The

implications of discarding Torulopsis rosea as the type and of replacing it by Torulopsis colliculosa (Hartmann) Saccardo should be carefully reviewed, and any desirable international action recommended.

12. The status of Candida as a generic name is indicated as problematical and tentative. One may hope for a prompt decision from the Committee on the Nomenclature of the Fungi appointed by the Stockholm Botanical Congress, to which Committee the problem has been referred.

13. The type species is designated as Candida albicans (Robin) Berkhout. However, C. vulgaris Berkhout was chosen by Clements and Shear (1931). The authors note that C. vulgaris Berkhout is to be regarded as a synonym of C. tropicalis (Castellani) Berkhout. Should C. tropicalis be regarded, therefore, as the type species?

14. The great amount of work done by the various groups of yeast specialists in bringing order out of zymological chaos is illustrated by the listing of ninety-one synonyms for the species Candida albicans.

15. An interesting complication arises in the discussion of Candida mycoderma by the authors. The statement is made (p. 483):-"Pichia membranifaciens Hansen has to be regarded as the perfect stage of this species". The implications of this assertion require careful exploration in the light of Article 57 of the International Rules of Botanical Nomenclature, which seems to indicate that the name of the perfect form should be used when known.

16. The reasons for the designation of Trichosporon cutaneum as the type species of the genus Trichosporon are not sufficiently documented. Behrend (1890) is stated to have "created the genus Trichosporon" with the single species T. ovoides. This species would therefore seem to be the type; however, the authors state "according to Article 18 of the International

Rules of Botany Nomenclature Trichosporon cutaneum (de Beurmann, Gougerot et Vaucher) Ota is the type species of the genus". The writer can find nothing in Article 18 to justify this conclusion. The authors (p. 641) regard T. ovoides Behrend as a nomen dubium and reject it. This reasoning would seem to make the generic name Trichosporon Behrend questionable. Might T. ovoides Behrend be identified with one of the more recently described species, thus making the later description an emendation of that of Behrend? Or the generic name Trichosporon Behrend might be rejected and replaced by some later synonym. The authors are probably right in concluding that the acceptation of T. cutaneum as the type species would cause the least confusion in nomenclature. If this is done a suitable request for international approval should be formulated.

17. In this review Clements and Shear are several times quoted as having designated the type species in certain fungus genera. It should be noted that these authors definitely stated that they were designating the types in accordance with the well recognized rules of botanical nomenclature, but that the validity of their designations in many cases has been called into question as by Seaver (1932). The fact of these designations must be recognized by later workers, but their legitimacy may require careful checking. A ruling by the appropriate Committee on the legitimacy of the many designations thus made would be of material mycological assistance.

The Latin diagnoses required under the Botanical Code to make legitimate the names of new taxa are given as follows:

Saccharomyces four species (pp. 668-669).
Lipomyces genus and one species (p. 669).
Cryptococcus one variety (p. 670).
Torulopsis six species and one variety (pp. 670-671).
Candida three species and two varieties (p. 672).
Trichosporon one species (p. 673).

The author and taxonomic indices are adequate and admirable.

In the opinion of the writer, the time has come when a series of well formulated recommendations relative to the unsettled nomenclatural problems of the yeasts should be prepared and submitted to the International Committee on Mycological Nomenclature.

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NOMENCLATURAL AND TAXONOMIC REVIEWS

HARRISON, J. Heslop (London). Statistical Methods in Plant Taxonomy. Taxon 1(4):53-59, and 1(5):73-78, 1952. The considerable literature of the past fifteen years relative to the applicability and usefulness of the methods of biostatistics in plant taxonomy is adequately reviewed and discussed with special reference to application to the classification of the higher plants. It seems probable that some of the techniques presented should find some major applications in the fields of microbiology, particularly in bacteriology. Such adaptation to some of the problems of differentiation of the species' serotypes and biotypes of the enterobacteria is worthy of serious consideration. It is now more than two decades since Dr. Max Levine first called attention to the desirability of a statistical approach and used a statistical method in classifying members of the coliform group of bacteria. There seems to have been relatively little research in this field in recent years. Of importance from the standpoint of applicability in microbiology is Harrison's discussion of "Comparison of Populations" and particularly of "Character Correlation". Certain pertinent statements from his discussion of "Discrimination and Discriminant Functions" follow:

> "Orthodox classificatory procedures at all levels depend upon the recognition of character combinations, and the largest number derived from the widest range of structures. But all cannot be expected to have equal systemic value".
>
> "At species level the most useful characters tend to be those which show the greatest discontinuities, and this is of course also true of critical species complexes where intergrading variation tends to obscure what differences are present". - - - - -
>
> "Statistics is the mathematics of variation, primary aims of which are to reduce uncoordinated masses of data derived from individual observations to easily comprehended terms, and to attribute to those terms their correct value so that they can, if necessary, be made the basis for non-mathematical action."

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

NOMENCLATURAL AND TAXONOMIC REVIEWS

SINCLAIR, G. Winston. Diacritical Marks in Zoological Names. Systematic Zoology 1:84-86. 1952. One of the noteworthy differences between the rules of nomenclature in botany and bacteriology on the one hand and in zoology on the other is to be found in the spelling prescribed for use when a scientific name or epithet is derived from the name of a person and is written in a language using letters or diacritic signs that are not those of Latin. The recommendation 27 c (4) in the bacteriological code reads

> "When a new name for a genus or subgenus is taken from the name of a person, it should be formed in the following manner: The syllables which are not modified by--- endings retain their original spelling, even with the consonants k or w or with the groupings of vowels which were not used in the classical Latin. Letters foreign to botanical Latin should be transcribed and diacritic signs suppressed. The Germanic ä, ö, ü, become ae, oe, ue; the French é, è, and ê become generally e."

Article 20 in the Zoological Code reads

> "In forming names derived from languages in which the Latin alphabet is used, the exact original spelling, including diacritic marks, is to be retained."

Sinclair notes that in many languages letters with diacritic marks frequently are different letters occupying an independent place in the alphabet. He finds that in Czech there are nine such letters, in Turkish eight, in Polish eight, in Latvian eight. He states that there is a movement to do away with such diacritic marks when names are latinized. He emphasizes that diacritic marks are of two kinds: (a) those to which the name properly applies, the German Umlaut the French accents and cedilla, and the Portuguese til, and so on, where the mark indicates that the sound of the letter is in some way different from that proper to it; and (b) "by a loose extension of the term, those marks which, in combination with a letter, make a completely new character,

e.g., the Spanish ñ, the Czech č, ž, š, etc. It is possi- that these two groups should be treated differently."

The author concludes that it is often difficult for one unfamiliar with the language in question to draw a distinction between the two groups. He believes that the least difficulty will be encountered by strict adherence to the zoological rule that all diacritic signs should be included in derived names.

DANDY, J. E., J. S. L. Gilmour, T. A. Sprague, and E. M. Wakefield. Committee to Deal with Urgent Nomenclatural Needs. Memorandum by British Members. Taxon 1 (5): 78: 80. 1952. Both botanical and bacteriological codes of nomenclature emphasize the desirability for stability of names of higher plants and of the bacteria. It is particularly necessary that the names for organisms of economic significance and names that have come into wide use should be fixed. To further such stability there has been established for botany a "Committee to Deal with Urgent Nomenclatural Needs". This Committee apparently functions much as does the Judicial Commission in bacteriology in the formulation of recommendations concerning code emendation and interpretation. The British members of this Committee have published a suggested revision of those articles in the Botanical Code that have to do with conservation and rejection of specific names of plants. They have recommended to the Committee favorable action upon a proposed new article to follow old Article 68 and to replace old Articles 62-68. The problems with which the proposed article is concerned confront the bacteriologist as well as the botanist. The new article relates to the development of approved lists of conserved species names and lists of rejected species names.

The proposers of the new article agree that nomenclatural stability as well as continued "friendly cooperation between taxonomists and other users of the scientific names of plants" require some modification of existing rules whereby changes in widely used specific names of economic plants, at present rendered necessary by the application of the Rules,

may be reduced to a minimum in the future". The second of the two statements has particular application in bacteriology, in which science a large proportion of the names are used by men in medicine, in sanitary science, in agricultural sciences, in veterinary medicine, in food technology, in laboratory diagnosis, and in many other fields.

A list of conserved specific names (nomina specifica conservanda) is unanimously opposed for the reason that it would encourage the proposing of a great number of scientific names for conservation, frequently only because the names are those that are best known to the proposers. It is further contended that the conservation of species names would require the determination and designation of their types, and probably likewise accurate species delimitation. It is possible that these arguments might have somewhat less cogency when applied in the field of bacteriology.

It is urged that the alternative development of a list of names to be rejected (nomina specifica rejicienda) is much to be preferred. Such a list should not be applied retroactively, that is, changes that have already been made in accordance with the rules should not be reversed. It is recommended that the present provisions for the rejection of certain specific epithets be included in the new articles. The essential part of the proposed new article reads:-

> "A name of a species must be rejected if it is included in the list of nomina specifica rejicienda (Appendix __) Names in this list are to be treated as illegitimate."
>
> "The object of the list of nomina specifica rejicienda is to further the attainment of stability and unambiguity in the nomenclature of well-known species, especially familiar species of wide distribution and species of special horticultural, economic or other importance."

It is again emphasized that names to be rejected should be those that are valid under the rules, and that are not widely used. To be rejected names must belong to one of five categories:-

1. An unused earlier synonym of an established name.

2. A name used with different meanings.
3. A well known and currently used name in which it is found that the type belongs to another species.
4. A name based on two or more entirely discordant elements.
5. A name based on a monstrosity.

The procedure for securing the rejection of a name is for the Group Committee to recommend, the rejection to be confirmed by the Advisory Board and be finally approved by the next Botanical Congress. However, authors may reject the name following the action of the advisory committee and pending decision by a Congress.

BORMAN, Earle K. Nomenclature of Pathogenic and Parasitic Organisms. Ed. 2. Connecticut State Department of Health, Hartford, Connecticut. pp. 70, 1951. This brochure is intended to serve as a reference booklet to enable physicians in the state of Connecticut who are making use of the diagnostic facilities of the state laboratory to know something of the characteristics of the various organisms reported under the several scientific names. The booklet further proposes to standardize the nomenclature of the organisms identified insofar as this is necessary in the making of reports and diagnoses.

Eight lists of organisms are given, in each the important generic names are arranged alphabetically. The list of the bacteria includes the names and very brief characterization of 47 genera of medical interest, many of them including pathogens. The generic names recognized are those of the sixth edition of the Bergey Manual with the addition of Proshigella and Staphylococcus. Two genera, Bartonella and Rickettsia are included under "Rickettsial Organisms". The Holmes' names for the "Common viruses and related organisms" causing many of the diseases of man are employed. Eighty-seven genera of fungi of some medical significance are named, likewise eighteen genera of the parasitic protozoa. There are also included lists of the trematodes, cestodes, parasitic nematodes, and miscellaneous parasitic helminths.

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

PATEL, M. K. and Y. S. Kulkarni, Nomenclature of Bacterial Plant Pathogens. Indian Phytopathology. 4:74 - 84. 1951. The authors contend that "the inclusion of bacterial organisms inciting plant diseases in genera -- and families -- which have been set apart to include animal pathogens and saprophytes, having totally different physiological behaviour, seems -- to be very incongruous". They note that certain genera of bacteria as Xanthomonas, Agrobacterium, Pectobacterium, Erwinia and Phytobacterium include plant pathogens only and are not employed in "medical, veterinary or dairy bacteriology". They conclude that the bacterial plant pathogens now generally catalogued in such genera as Pseudomonas, Corynebacterium and Bacterium should be transferred to other genera characterized by "symptoms produced, in addition to the morphological and biochemical characters". A new family, the Phytobacteriaceae, is proposed to include all bacterial genera made up of plant pathogens. The name is based on the genus Phytobacterium segregated by Magrou and Prévot from Pseudomonas as emended by Dowson to include the non-pigmented plant pathogens. These authors also propose a new genus Chlorobacter, to include the "plant pathogens" producing green, fluorescent water-soluble pigment, previously included by Dowson in Pseudomonas. Chlorobacter syringae (van Hall) comb. nov. is designated the type species. Thirty-three new combinations are published. Specific epithets (as Chlorobacter angulatum) indicate that the authors regard the generic name Chlorobacter as neuter rather than the etymologically better masculine. Chlorobacter as a generic name may give rise to some confusion inasmuch as the generic name Chlorobacterium has been proposed twice previously in bacteriology and is currently used for a genus of chlorophyll-containing bacteria. There is also now recognized the family Chlorobacteriaceae including several genera of green photosynthetic bacteria.

The detailed key to the genera shows the family Phytobacteriaceae to include the following genera:

Xanthomonas Dowson, Phytobacterium Magrou

and Prévot, Chlorobacter Patel and Kulkarni, Pectobacterium Waldee, Erwinia Winslow et al emend. Patel and Kulkarni, Agrobacterium Conn and Aplanobacter Smith emend. Patel and Kulkarni.

The designation by the authors of Aplanobacter michiganense Smith as the type species of the emended genus Aplanobacter should be studied carefully in the light of Smith's original designation of Aplanobacter anthracis as the genotype. The inference that Aplanobacter was intended by Erwin F. Smith to include plant pathogens only is scarcely justified.

The erection of genera based exclusively upon plant pathogenicity; and the inclusion of genera characterized in some cases by polar flagella, in one by the absence of flagella and in two by peritrichous flagella in one family will be questioned.

In the table (I) the authors apparently inadvertently include characterization of a genus Aerobacterium. Possibly this is a misprint for Aerobacter.

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